TAL TECH

HOONETE ENERGIATÕHUSUSE VÕIMALUSTEST JA VÄLJAKUTSETEST

Jarek Kurnitski

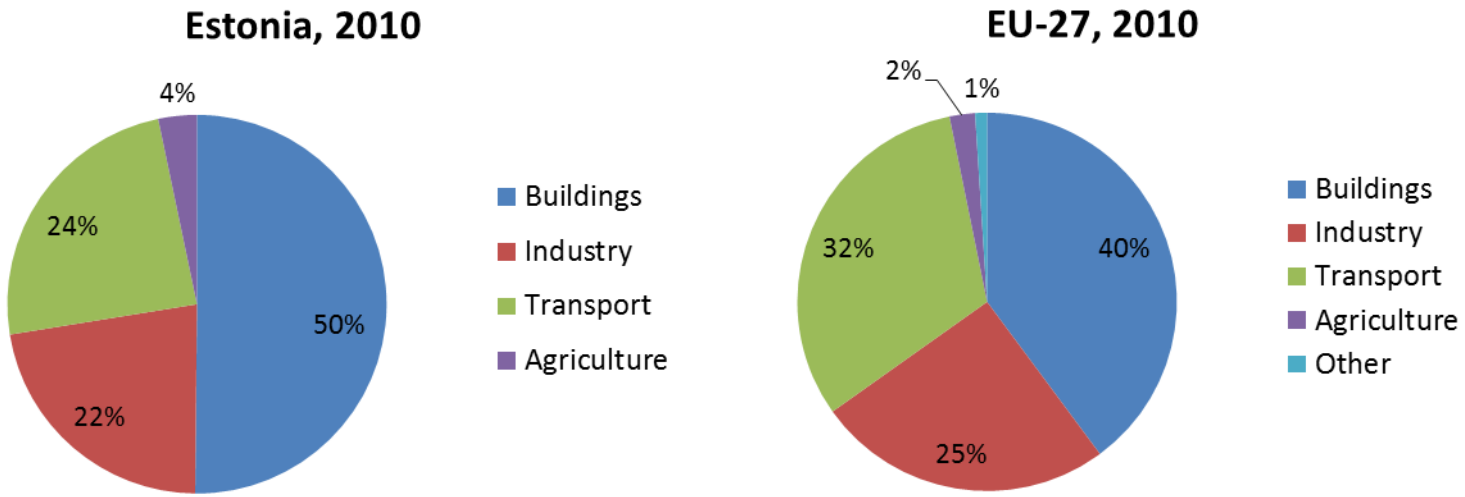
13.09.2019

Teadmistepõhise ehituse tippkeskus

Zero Energy Centre of Excellence

HOONETE ENERGIATÕHUSUSE JA SISEKLIIMA OLULISUS

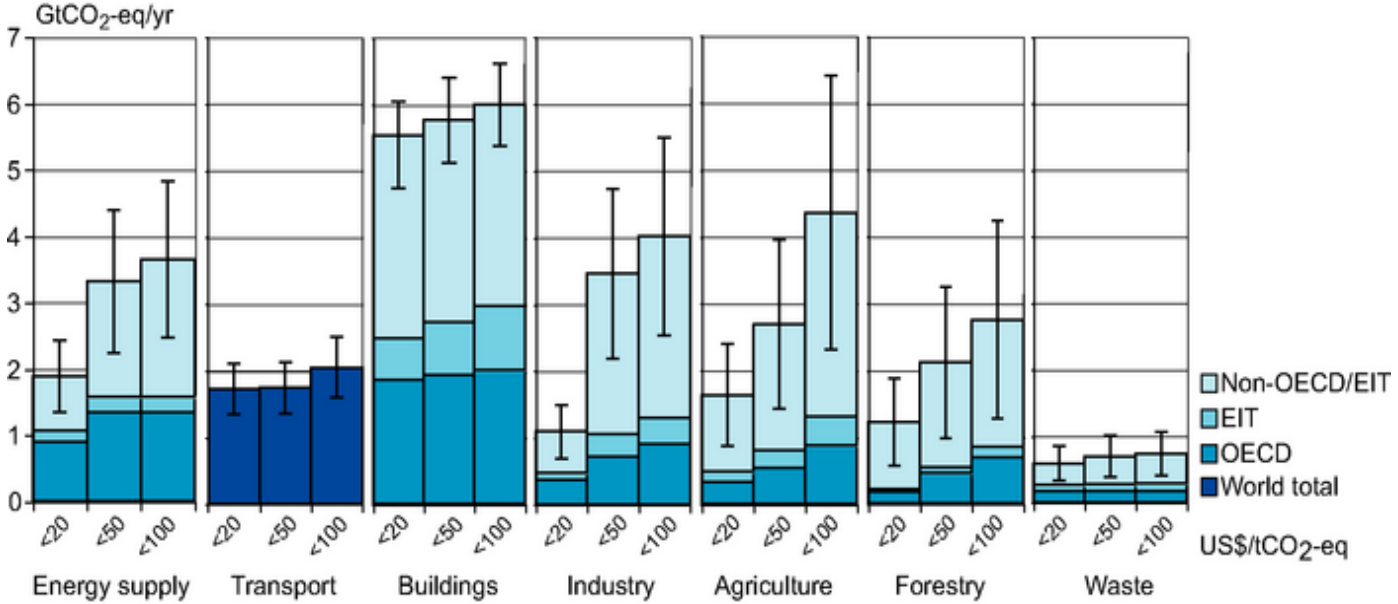
- Energia lõpptarbimine Eestis ca 33→32 TWh/a (2010–2015)
- Hoonete osakaal kasvamas üle 50% (ilma tööstushooneteta)
- EL keskmine 40%
- Olemasolev hoonefond EL-i „kõige suurem energeetiline ressurss“



TAL TECH

http://www.energiatalgud.ee/img_auth.php/c/c1/ENMAK-Hoonete-uuring-20.09.2013.pdf

IPCC: HOONETES ON GLOBAALSELT MAJANDUSLIKULT KÕIGE SUUREM POTENTSIAAL



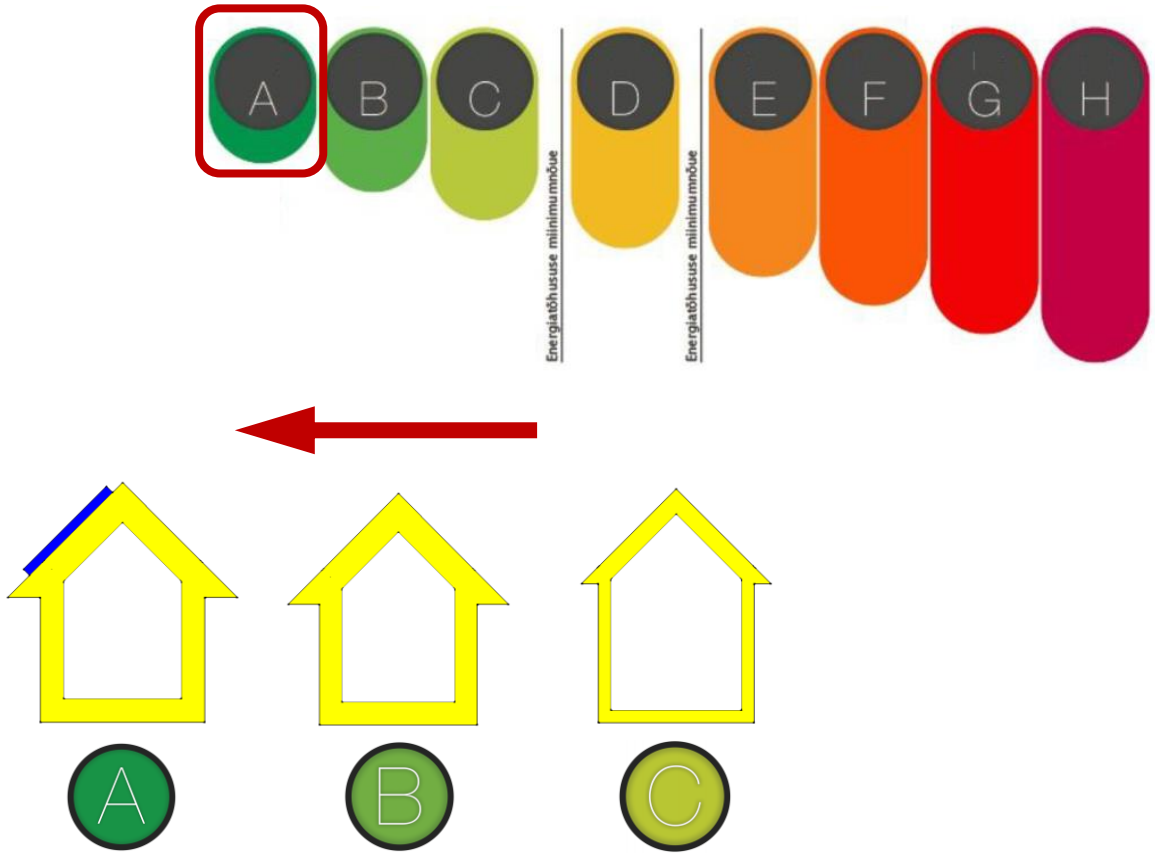
Energy supply	Transport	Buildings	Industry	Agriculture	Forestry	Waste
(potential at <US$100/ tCO_2-eq: 2.4 - 4.7 Gt CO_2-eq/ yr)	*(potential at <US$100/ tCO_2-eq: 1.6 - 2.5 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 5.3 -6.7 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 2.5 - 5.5 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 2.3 -6.4 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 1.3 - 4.2 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 0.4 - 1 Gt CO_2-eq/yr)*

- http://www.ipcc.ch/publications_and_data/ar4/wg3/en/contents.html
- http://www.ipcc.ch/publications_and_data/ar4/wg3/en/spmsspm-c.html

- Hoonete energiatõhusus on globaalselt kõige suurem ja kõige soodsam sektor emissioonide vähendamiseks
- Vajalikud eraldi meetmed uutele ja rekonstrueeritavatele hoonele

UUED HOONED – LIGINULLENERGIAHOONED ALATES 2020

Liginullenergiahoone on **energiatõhusate ja taastuvenergia-tehnoloogia** lahendustega tehniliselt mõistlikult ehitatud hoone.



LIGINULLENERGIAHOONETE NÄITEID

TAL TECH

LIGINULLENERGIAHOONETE NÄITEID

Büroohoone Järvevana teel ei ole mitte ainult liginullenergiahoone, vaid demonstreerib rohelist mõtteviisi laiemalt

Foto: Mitt & Perlebach

Superministeerium

Suur-Ameerika 1, Tallinn

Sotsiaalministeerium

Indikaator	Vana	Uus	Erinevus	%
Aastane energiakasutus	7,041 MWh	2,030 MWh	**-5,011 MWh**	71%

Majandus- ja Kommunikatsiooniministeerium

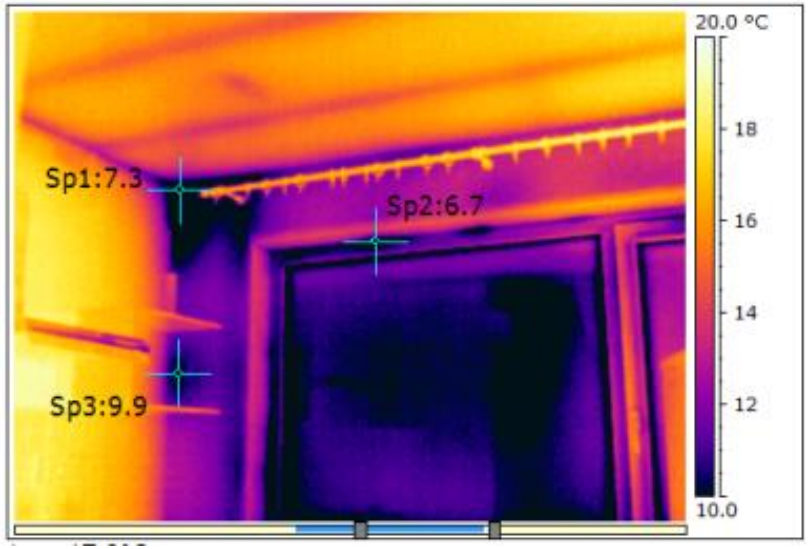
Justiitsministeerium

Riigi Kinnisvara

Eesti elamufond

≈ 34 miljonit m^2

71% elanikest elab korterelamutes, mis on ehitatud peamiselt perioodil 1950–90



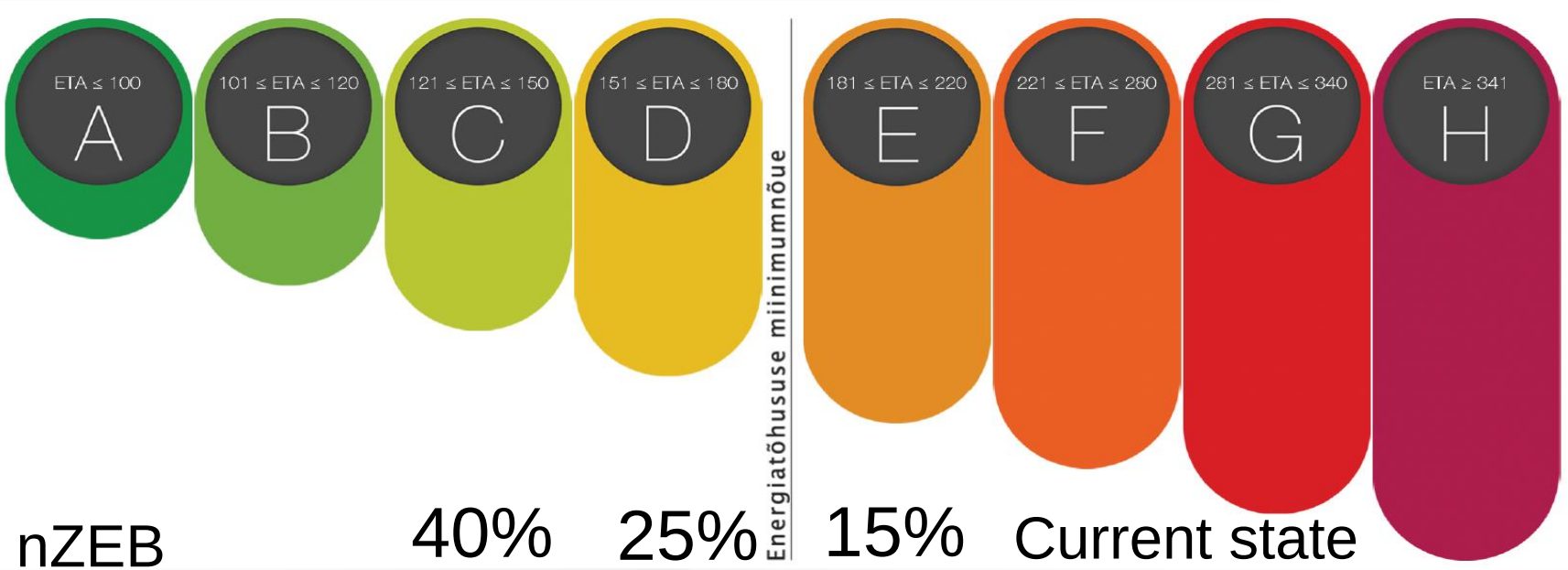
PIKAAJALINE REKONSTRUEERIMISSTRATEEGIA 2020-50

- Liikmesriigid loovad pikaajalise renoveerimisstrateegia, mis hõlmab kogu hoonefondi (Uuendatud hoonete energiatõhususe direktiiv EPBD 2018)
- Eesmärgiks on olemasolevate hoonete **kulutõhus ümberehitus liginullenergiahooneteks** (= energiamärgise C klass Eesti süsteemis)
- Tegevuskava hõlmab soovituslike vahe-eesmärke 2030, 2040 ja 2050 a.

- Strateegia ja tegevuskava koostamine 2019-3/2020
- Strateegia hõlmab:
  - kulutõhusate lahenduste määratlemist;
  - poliitikaid ja meetmeid, edendamaks renoveerimise terviklahenduste rakendamist;
  - turutõrgete käsitlust;
  - investeeringute vahendeid ja mobiliseerimist.

TAL TECH

Grants 15%, 25% and 40%

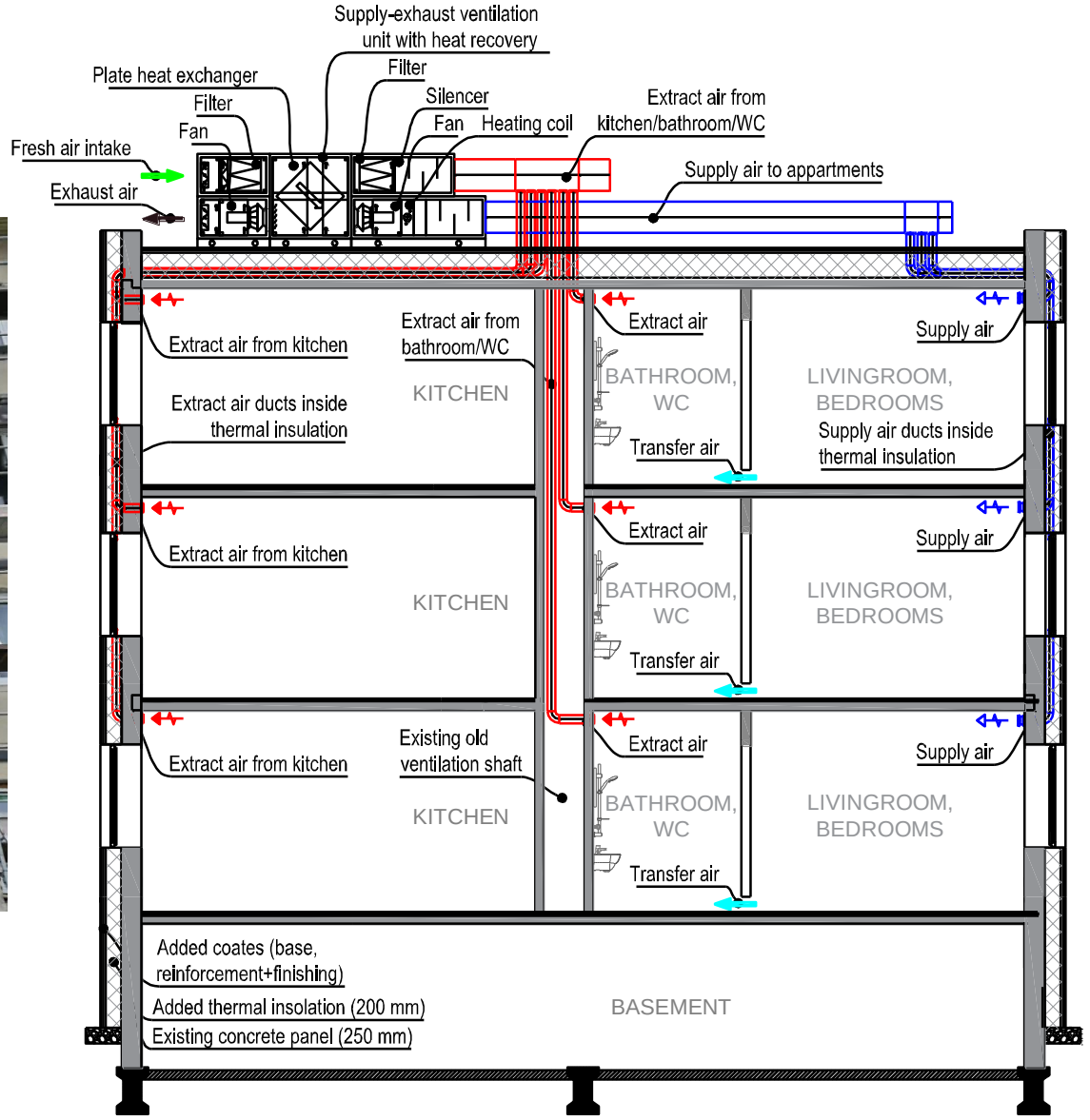


2015-2020	nZEB	40%	25%	15%	Current state
	+ more strict ventilation and other requirements				
2010-2014		35%	25%	15%	

Example: Sõpruse pst 202, Tallinn

- 11 375 m² (162 ap. 2012-2013)
- Investment € 2 062 000, 181 €/m²
- Grant 35% € 721 600, 63 €/m²
- Credit € 1 340 000, 20 years
- Measured annual savings 63%, ~500 MWh

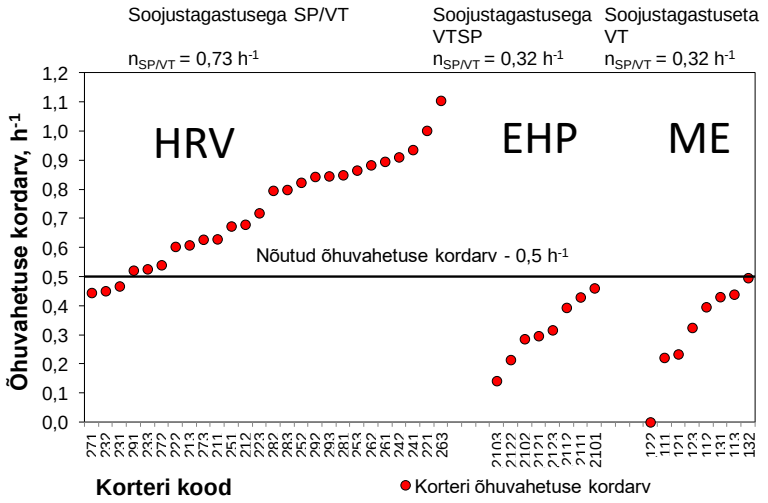
2015 innovation = mainstream solution 2018

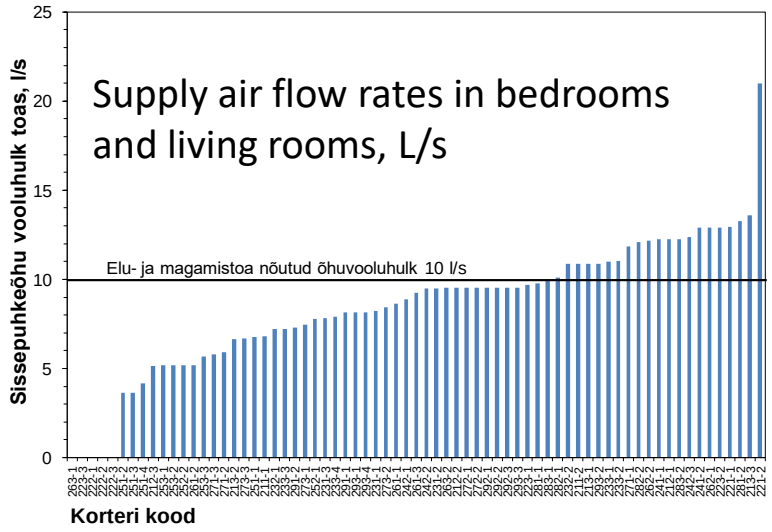


TAL TECH

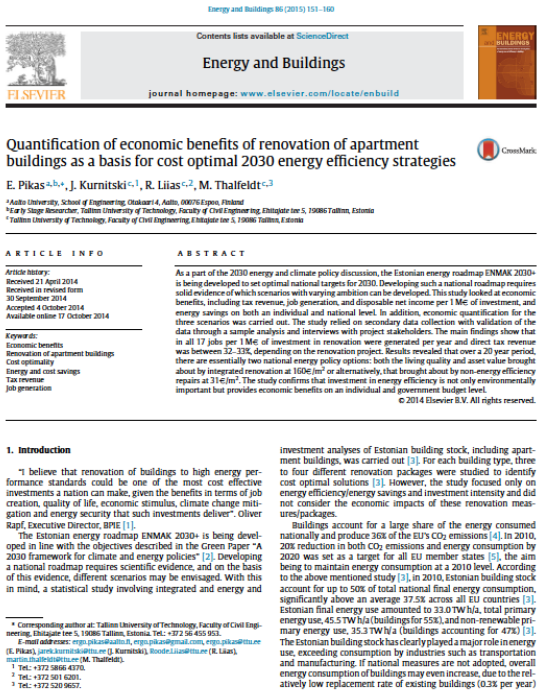
Healthy buildings: First time in the history (large scale in the world) renovated apartments have adequate ventilation

- Measurement protocols report required ventilation rates in all apartments
- **Measured in operation, average of all apartments 0,57 h^{-1}**
- According to ventilation system:
  - **Heat recovery mechanical supply and extract (HRV) 0,73 h^{-1}**
  - Exhaust air heat pump (EHP) 0,32 h^{-1}
  - Mechanical exhaust (ME) 0,32 h^{-1}
- Supply and extract air flows in the rooms in adequate level:
  - Bedrooms and living rooms 9 L/s
  - Bathrooms and toilets 11 L/s
  - Average per person 6 L/s, pers





RENOVEERIMISHANKE MAKSUTULU MOODUSTUMINE



Energy and Buildings 86 (2015) 151–160

Contents lists available at ScienceDirect

Energy and Buildings

journal homepage: www.elsevier.com/locate/enbuild

Quantification of economic benefits of renovation of apartment buildings as a basis for cost optimal 2030 energy efficiency strategies

E. Pikas[a,b,*], J. Kurnitski[c,1], R. Liias[c,2], M. Thalfeldt[c,3]

[a] Aalto University, School of Engineering, Otakaari 4, Aalto, 00076 Espoo, Finland
[b] Early Stage Researcher, Tallinn University of Technology, Faculty of Civil Engineering, Ehitajate tee 5, 19086 Tallinn, Estonia
[c] Tallinn University of Technology, Faculty of Civil Engineering, Ehitajate tee 5, 19086 Tallinn, Estonia

ARTICLE INFO

Article history:
Received 21 April 2014
Received in revised form
30 September 2014
Accepted 4 October 2014
Available online 17 October 2014

Keywords:
Economic benefits
Renovation of apartment buildings
Cost optimality
Energy and cost savings
Tax revenue
Job generation

ABSTRACT

As a part of the 2030 energy and climate policy discussion, the Estonian energy roadmap ENMAK 2030+ is being developed to set optimal national targets for 2030. Developing such a national roadmap requires solid evidence of which scenarios with varying ambition can be developed. This study looked at economic benefits, including tax revenue, job generation, and disposable net income per 1 M€ of investment, and energy savings on both an individual and national level. In addition, economic quantification for the three scenarios was carried out. The study relied on secondary data collection with validation of the data through a sample analysis and interviews with project stakeholders. The main findings show that in all 17 jobs per 1 M€ of investment in renovation were generated per year and direct tax revenue was between 22–33%, depending on the renovation project. Results revealed that over a 20 year period, there are essentially two national energy policy options: both the living quality and asset value brought about by integrated renovation at 160 €/m² or alternatively, that brought about by non-energy efficiency repairs at 31 €/m². The study confirms that investment in energy efficiency is not only environmentally important but provides economic benefits on an individual and government budget level.

1. Introduction

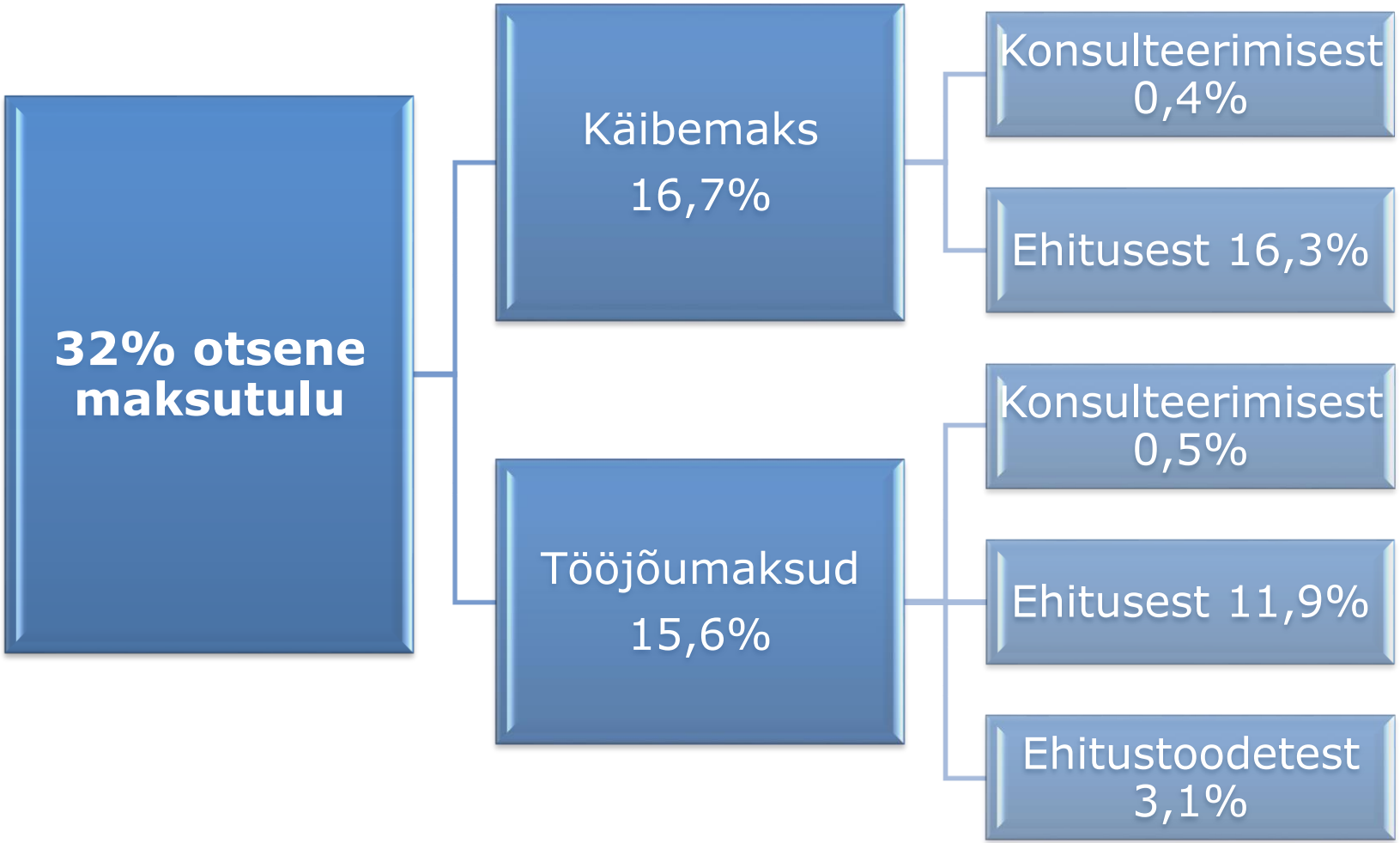
"I believe that renovation of buildings to high energy performance standards could be one of the most cost effective investments a nation can make, given the benefits in terms of job creation, quality of life, economic stimulus, climate change mitigation and energy security that such investments deliver". Oliver Rapf, Executive Director, BPIE [1].

The Estonian energy roadmap ENMAK 2030+ is being developed in line with the objectives described in the Green Paper "A 2030 framework for climate and energy policies" [2]. Developing a national roadmap requires scientific evidence, and on the basis of this evidence, different scenarios may be envisaged. With this in mind, a statistical study involving integrated and energy and investment analyses of Estonian building stock, including apartment buildings, was carried out [3]. For each building type, three to four different renovation packages were studied to identify cost optimal solutions [3]. However, the study focused only on energy efficiency/energy savings and investment intensity and did not consider the economic impacts of these renovation measures/packages.

Buildings account for a large share of the energy consumed nationally and produce 36% of the EU's CO_2 emissions [4]. In 2010, 20% reduction in both CO_2 emissions and energy consumption by 2020 was set as a target for all EU member states [5], the aim being to maintain energy consumption at a 2010 level. According to the above mentioned study [3], in 2010, Estonian building stock account for up to 50% of total national final energy consumption, significantly above an average 37.5% across all EU countries [3]. Estonian final energy use amounted to 33.0 TWh/a, total primary energy use, 45.5 TWh/a (buildings for 55%), and non-renewable primary energy use, 35.3 TWh/a (buildings accounting for 47%) [3]. The Estonian building stock has clearly played a major role in energy use, exceeding consumption by industries such as transportation and manufacturing. If national measures are not adopted, overall energy consumption of buildings may even increase, due to the relatively low replacement rate of existing buildings (0.3% per year)

* Corresponding author at: Tallinn University of Technology, Faculty of Civil Engineering, Ehitajate tee 5, 19086 Tallinn, Estonia. Tel.: +372 56 455 952.
E-mail addresses: ergo.pikas@aalto.fi, ergo.pikas@gmail.com, ergo.pikas@ttu.ee (E. Pikas), jarek.kurnitski@ttu.ee (J. Kurnitski), Roode.Liias@ttu.ee (R. Liias), martin.thalfeldt@ttu.ee (M. Thalfeldt).
[1] Tel.: +372 5866 4370.
[2] Tel.: +372 501 6201.
[3] Tel.: +372 520 9657.

http://dx.doi.org/10.1016/j.enbuild.2014.10.004
0378-7788/



ENMAK 2030 HOONETE STSENAARIUMID – LÄHEVAD UUENDAMISELE REKONSTRUEERIMISSTRATEEGIAS

- **Riigi panustamine toob tulu nii erasektorile kui riigile (S2)**
- S3 võib olla põhjendatav tööhõive, ekspordi ning majanduse stimuleerimisega

	Maksumus Riik, M€/a	Maksumus Erasektor, M€/a	Tulud Riik, M€/a	Tulud Erasektor, M€/a	Otsene tööhõive in-a/a
S1	3.6	48.5	17.5	**-1.4**	880
S2	**40.5**	130.5	**57.5**	61.0	2850
S3	126.2	227.7	111.8	140.4	5620

SEI: 240 M€/a

- Maksumused ilma uusehituseta, mille mahtu stsenaariumid ei mõjuta
- Riigi tuludeks on arvestatud maksutulu rekonstrueerimisest ja sisekliima tagamisega saavutatav sääst
- Erasektori tulud: energiasääst ja kinnisvara väärtuse tõus

TAL TECH

https://energiatalgud.ee/index.php/ENMAK:Stsenaariumid

KUIDAS SAAVUTADA STRATEEGIA EESMÄRKE?

- Hoonete eesmärgid on arvulised ja seotud energiaga (lõpptarbimine ja primaarenergia), aga peavad toetama CO_2-mahukuse vähendamist
- Tõhususe parandamine = vähem tootmisvõimsusi vajab uuendamist – oluline väljalangevate tootmisvõimsuste kontekstis
- Mitteelamud vajavad võimenduse ja garanteerimiskohustusega finantsinstrumenti, mis paneks omanikud investeerima (eeskujuks sobib KIK-i ressursitõhususe meede tööstustele)
- Elamute rekontsrueerimistoetuste ja lammutustoetuse meetmete tugevdamise ja jätkamise vajadus ilmne – samaaegne võimalus regionaalpoliitikaks – väikelinnade ja kahanevate asulate hoonefondi korrastamiseks ja atraktiivseks muutmiseks
- Kas isetasuvus on võimalik? Taastumatu elektri ja soojuse lisaaktsiisi kehtestamine CO_2-mahukuse järgi (va tööstusele) võimaldaks rahastada meetmeid + CO_2 maksustatud energia paneks omanikud investeerima või rohelist energiat ostma

TAL TECH